



The Multimission Operations Concept at the German Space Operations Center

**Michael Schmidhuber, Thomas Kuch
– DLR Oberpfaffenhofen –**



**Deutsches Zentrum
für Luft- und Raumfahrt e.V.**
in der Helmholtz-Gemeinschaft

michael.schmidhuber@DLR.de

www.DLR.de

www.DLR.de/RB



Multimission at GSOC - Overview

- DLR and GSOC
- Missions in Multimission
- 24 hour Operations Team
- Multimission Control Room
- Multimission Software
- Restrictions and Summary



DLR is Germany's aerospace research center and space agency.

Sites and Staff

5100 employees in 27 research institutes and scientific/technical Facilities at:

- 8 sites
- 7 field offices (only 2 shown here)

Offices in Brussels, Paris and Washington.

German Space Operations Center



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

German Space Operations Center (GSOC)



Control Center @ Oberpfaffenhofen



➤ Earth Observation

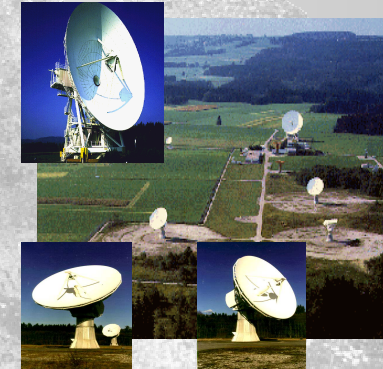
➤ Communication

➤ Navigation

➤ Human Spaceflight

➤ Design & Operation of Communication Infrastructure

➤ Research & Development of New Technologies



Ground Station @ Weilheim

■ Oberpfaffenhofen
Control Center
● Weilheim
Ground Station



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

German Space Operations Center (GSOC)

Manned Missions

1983 Spacelab-1
 1985 Spacelab D1
 1992 Mir 92
 1993 Spacelab D2
 1994 X-SAR 1
 1995 Euromir 95
 1996 MOMS / Priroda
 1997 MIR 97
 2000 X-SAR / SRTM
 2005 ISS Eneide
 2006 ISS Astrolab

 2007 ISS ATV-1
 2007 ISS Columbus

* launch dates

black: mission completed

red: in operation

blue: in preparation

Scientific & EO Missions

1969 AZUR
 1972 AEROS-A
 1974 AEROS-B
 1974 Helios 1
 1976 Helios 2
 1984 AMPTE
 1986 IRS 1A
 1988 IRS 1B
 1989 Galileo
 1990 ROSAT
 1995 EXPRESS
 1996 MARS 96
 1997 Equator-S
 1999 ABRIXAS

 2000 CHAMP
 2001 BIRD
 2002 GRACE
 2006 SAR-Lupe 1

 2007 TerraSAR-X
 2007..8 SAR-Lupe 2-5
 2009 TanDEM-X
 2011 EnMAP

Comm. & Navigation Missions

1974 Symphonie-A
 1975 Symphonie-B
 1987 TV-SAT 1
 1989 TV-SAT 2
 1989 DFS Kopernikus 1
 1990 DFS Kopernikus 2
 1990 EUTELSAT II-F1
 1991 EUTELSAT II-F2
 1991 EUTELSAT II-F3
 1992 EUTELSAT II-F4
 1992 DFS Kopernikus 3
 1994 EUTELSAT II-F5
 1995 EUTELSAT II-F6
 1998 EUTELSAT W2
 1999 EUTELSAT W3
 2000 EUTELSAT W4
 2001 EUTELSAT W1R
 2002 EUTELSAT HB6
 2002 EUTELSAT W5

 2006... Galileo GSTB V2
 2008... Galileo IOV
 2010... Galileo FOC
 2008... SATCOMBw



Deutsches Zentrum
 für Luft- und Raumfahrt e.V.
 in der Helmholtz-Gemeinschaft

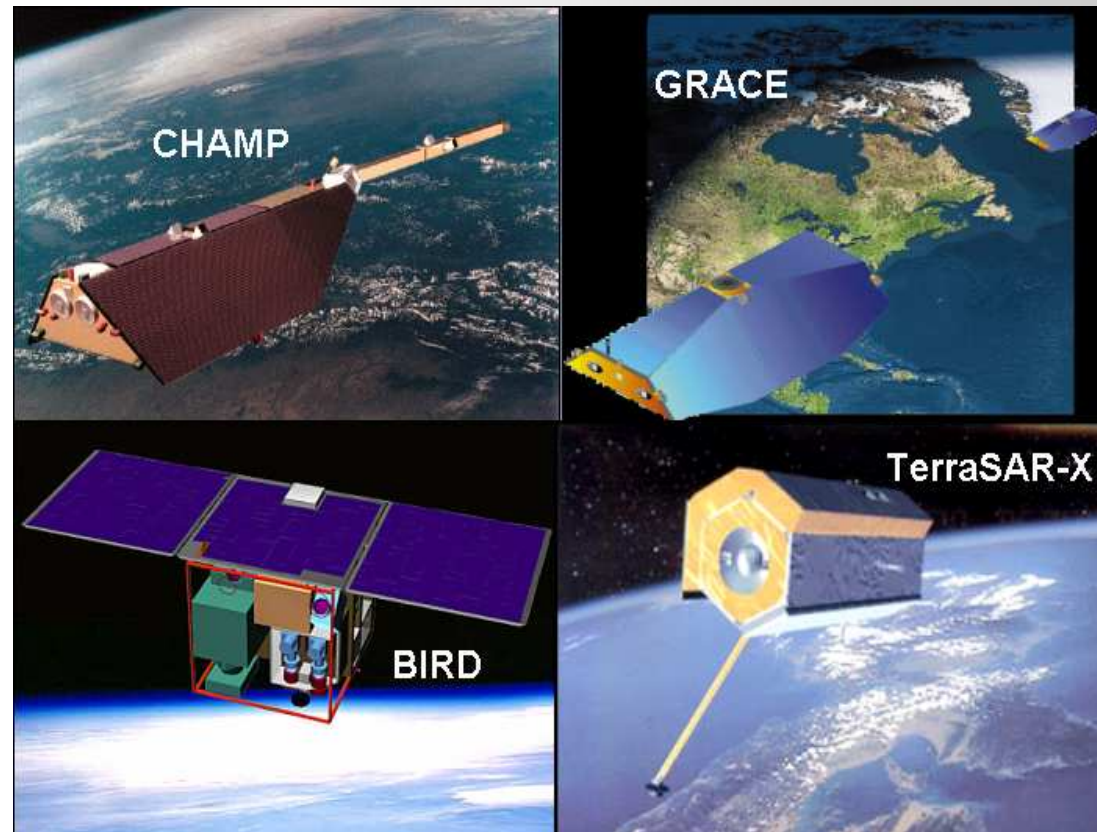
Multimission at GSOC

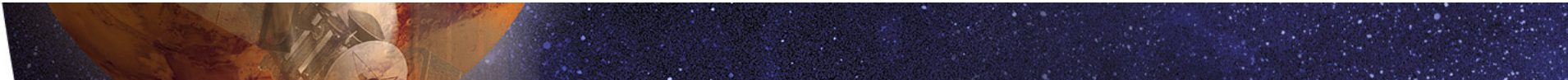
- Projects in Multimission

- BIRD
- CHAMP
- GRACE 1 & 2

- Next Projects planned for Multimission

- TerraSAR-X (in 2007)
- TanDEM-X (in 2009)
- EnMAP (in 2011)
- TET (in 2009)





Multimission at GSOC

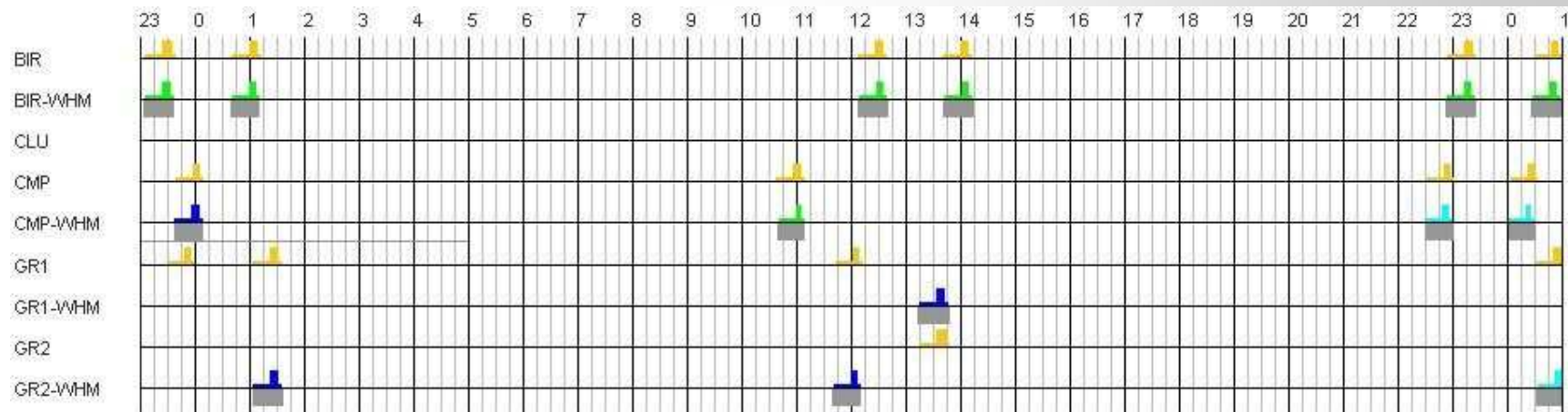
- 24 Hour Operations Team

- Staff is provided by contractors
- A 24 hour shift is established where one person is always available.
- This person is reinforced in times of higher activities (flexi-shift)
- All multimission-team members are trained on all spacecraft
- Team size is large enough to adapt the shift easily for holidays, sick-leave and fluctuations
- The team is performing operations autonomously
- They are supported by the spacecraft subsystem specialists

Multimission at GSOC

- 24 Hour Operations Team (continued)

- The same team also supports the command positions of projects in preparation and during LEOP
 - The experience and know-how from multimission operations is available to new project teams
 - The spacecraft knowledge is directly transferred into the multimission team



Multimission at GSOC

- Multimission Control Room

- All missions are flown from the same control room
- Each project has dedicated consoles to allow continuous work layout
- All computers are identical, as far as possible, to allow easier upgrade and moving of positions



Multimission at GSOC

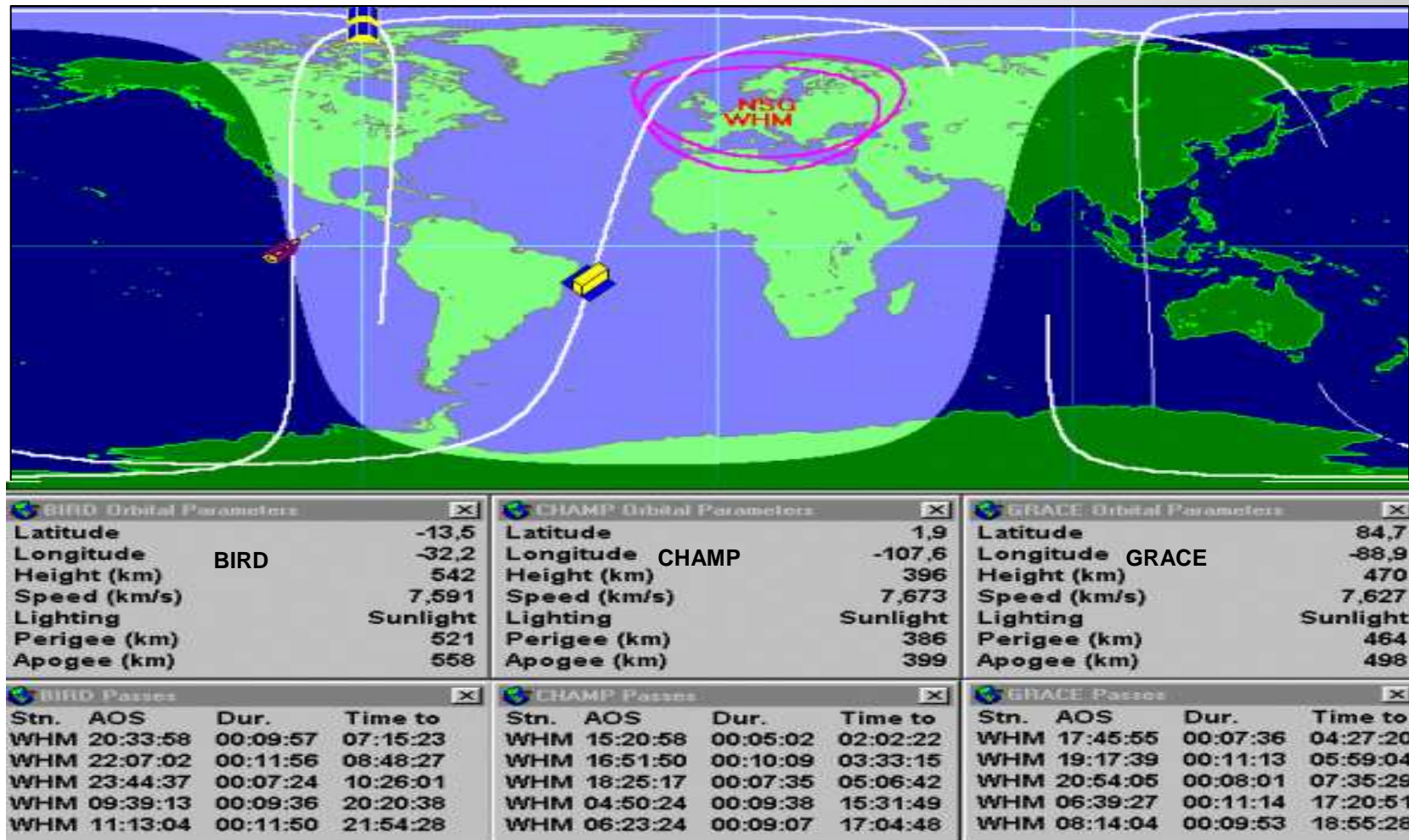
- Multimission Control Room (continued)

- A typical workplace has three monitors on two computers
- One machine gives access to office applications, intranet and internet
- The other is connected to the operations LAN and can display telemetry as well as open the command system
- Operators may arrange machines individually



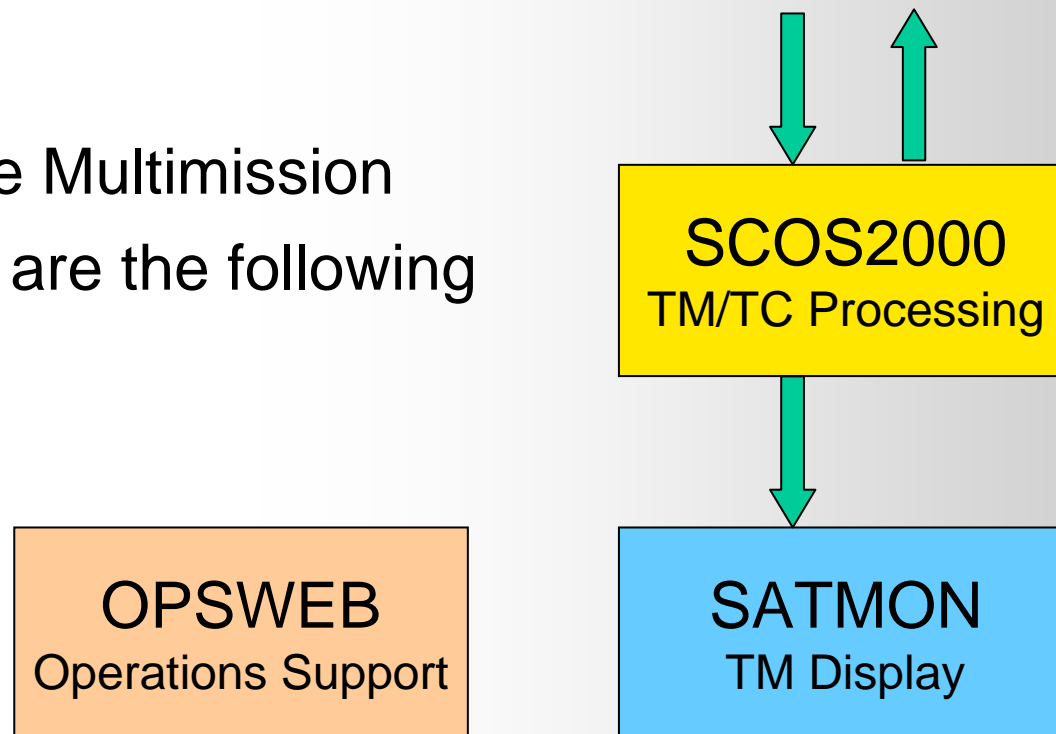
Multimission Operations

Earth Observation Missions



Multimission at GSOC - Multimission Software

Central to the Multimission environment are the following applications:





Multimission at GSOC

- SCOS 2000

- SCOS 2000 is the GSOC Monitor & Control System of choice for new satellite projects
- SCOS-2000 was developed and is constantly upgraded by ESOC
- For the use at GSOC, SCOS is adapted and customized by contractors
- GSOC is currently using SCOS in version 3.1 for CHAMP and for TerraSAR-X
- The widely known and accepted standard of SCOS and its database format guarantee the availability of experts and problem resolutions.

Multimission at GSOC

- SCOS 2000 (continued)

SCOS-2000 Manual Stack 0 W/S: spc12 S/C: TSX []

FILE EDIT PRINT VIEW ARM burn Stack Name CONNECTED EXIT

STATUS

LINK: GREEN GLOBAL: ENABLED DYNAMIC PTV: ENABLED VERIFICATION: ENABLED INTERLOCK: NONE

TC: GREEN GLOBAL: ENABLED DYNAMIC PTV: ENABLED VERIFICATION: ENABLED INTERLOCK: NONE MASTER MANUAL MODE: NONE WAIT MODE: DISABLED AUTO REJECT: OFF TRANSMISSION MODE: AD SOURCE: RUNNING

TM: GREEN LOCAL: ENABLED DYNAMIC PTV: ENABLED VERIFICATION: ENABLED INTERLOCK: NONE MASTER MANUAL MODE: NONE WAIT MODE: DISABLED AUTO REJECT: OFF TRANSMISSION MODE: AD SOURCE: RUNNING

CONTROL

STA. ENA: DYN. ENA: CEV: INTERLOCK: REQUEST: WAIT MODE: AUTO REJECT: AD: ARM: STOP: SUSPEND: GO

CHD... SEQ... Reset IL: SUB-SYSTEMS... DISPLAY MODE: EXPANDED BRIEF No. of Entries: 49

Num	Name	Description	Ct	St.	PTV	Dyn.	PTV	MD	Release Time	IL	G	B	CEV	Execution Time	Par. Seq.	Sub-Sys
1	CCC00001	ACS3010N CESS_PAR_DMP	N	GO	E	GO	E		00.00.01				E	IMMEDIATE		TX_CS
2	ASC61004	GET_PS04_SENS_PROC	N	GO	E	GO	E		00.00.01				E	IMMEDIATE		AOCS
3	ASC61005	GET_PS05_AOCS_CONF	N	GO	E	GO	E		00.00.02				E	IMMEDIATE		AOCS
4	ASC51011	Get_CESS_CalibrationPars	N	GO	E	GO	E		00.00.02				E	IMMEDIATE		AOCS
5	CCC00000	CHECK PROC POST-CONDITION	N	GO	E	GO	E	M	00.00.01				E	IMMEDIATE		COMMON
6	CCC00001	AST1021N STR_1_OFF	N	GO	E	GO	E		ASAP				E	IMMEDIATE		COMMON
7	BSC00900	F009 CAT1_LCL_OFF	N	GO	E	GO	E		00.00.01				E	IMMEDIATE		COMMON
8	CCC00001	AST1022N STR_2_OFF	N	GO	E	GO	E		ASAP				E	IMMEDIATE		COMMON
9	BSC00900	F009 CAT1_LCL_OFF	N	GO	E	GO	E		00.00.01				E	IMMEDIATE		COMMON
10	CCC00001	AST1023N STR_3_OFF	N	GO	E	GO	E		ASAP				E	IMMEDIATE		COMMON
11	BSC00900	F009 CAT1_LCL_OFF	N	GO	E	GO	E		00.00.01				E	IMMEDIATE		COMMON
12	CCC00001	AGP1021N GPS_1_RX_OFF	N						ASAP					IMMEDIATE		COMMON
13	CCC00000	Verify conditions	N					M	00.00.01					IMMEDIATE		COMMON
14	YSC01400	F014 SET_GPS_PWR	N						00.00.01					IMMEDIATE		COMMON
15	CCC00001	AGP1022N GPS_2_RX_OFF	N						ASAP					IMMEDIATE		COMMON
16	CCC00000	Verify conditions	N					M	00.00.01					IMMEDIATE		COMMON
17	YSC01400	F014 SET_GPS_PWR	N						00.00.01					IMMEDIATE		COMMON
18	CCC00001	AOC3001N AOC_ANYM_TLM_REN	N						00.00.01					IMMEDIATE		COMMON
19	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
20	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
21	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
22	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
23	ASC50013	Def HK Param Rep Coll	N						00.00.01					IMMEDIATE		COMMON
24	ASC50013	Def HK Param Rep Coll	N						00.00.01					IMMEDIATE		COMMON
25	ASC50013	Def HK Param Rep Coll	N						00.00.01					IMMEDIATE		COMMON
26	ASC50013	Def HK Param Rep Coll	N						00.00.01					IMMEDIATE		COMMON
27	CCC00000	FOLLOWING OPTIONAL	N					M	00.00.01					IMMEDIATE		COMMON
28	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
29	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
30	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
31	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
32	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
33	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON
34	ASC50007	Dis HK Param Report Gen	N						00.00.01					IMMEDIATE		COMMON

054.08.28.34 : Deleting done.

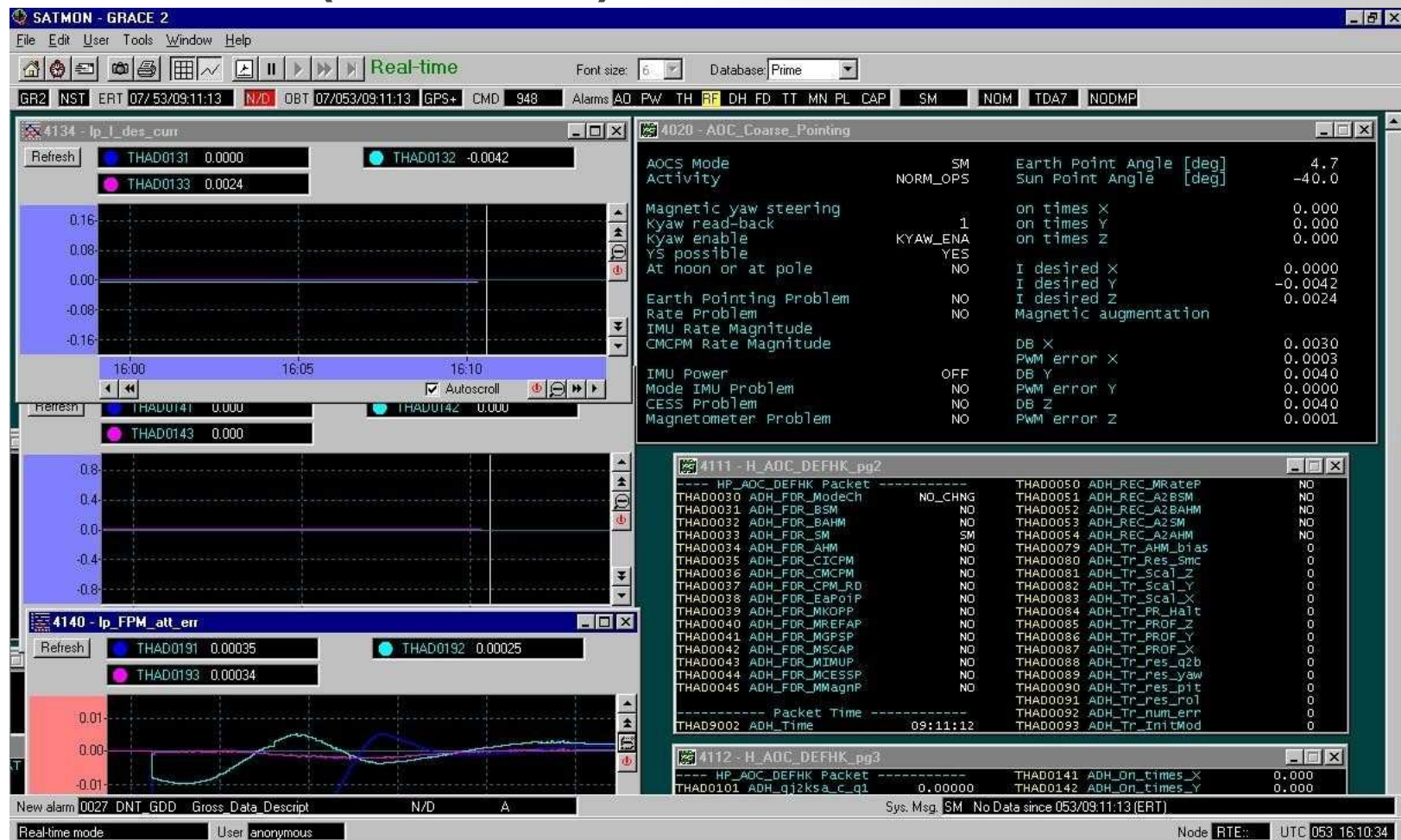




Multimission at GSOC - SATMON

- SATMON is the GSOC telemetry display for all missions
- For all projects the same user interface is maintained although processing systems are different (SCOS, EPOCH, MCS, FRAMTEC)
- SATMON is developed by „Heavens-Above“ mainly for GSOC, but also for other customers
- Development is strongly influenced by the experiences gained in Multimission operations and several LEOPs

Multimission at GSOC - SATMON (continued)





Multimission at GSOC - OPSWEB

- OPSWEB is the GSOC intranet for satellite missions
- The OPSWEB is reachable from the control room, the offices and partially also from external locations
- It is the central location for data, tools and documentation
- For all projects a similar user interface is maintained although background data may be different (e.g. TM database viewer connects to SCOS, EPOCH and FRAMTEC; flight ops procedures may be MOIS or other format)
- Improvements triggered by new projects go directly into existing projects
- Multimission-Operators integrate and use their manuals via the OPSWEB
- Project logging is done directly in the OPSWEB

Multimission at GSOC - OPSWEB (continued)

**Operations Related
Pass Log GRACE 1 & 2**

(Jump Station) (lookup selection in ...)

The OPS Pass Logs are filled out by the command operators after each pass. You must be inside GSOC to add or edit records.

List ☒ GR1 ☒ GR2 pass reports of CW < 23 > / 2007

AOS-LOS	GRACE	Station	Operator	Cmd. Ctr. Pre / Post	MMU	OBDR	Gas [g]	AOCs Mode	IPU	Comment	Action
08-Jun-2007 (159) 00:57 - 01:06	1	S67	Patrick	15138 / 15329	B	Main	2393 / 3654 3.485	SM	Main	s/c status o.k	View...
08-Jun-2007 (159) 00:55 - 01:05	2	NST	Patrick	10723 / 10723	B	Main	4970 / 4839 2.078	SM	Main	s/c status o.k	View...
07-Jun-2007 (158) 23:21 - 23:30	1	NST	Patrick	15138 / 15138	B	Main	4300 / 5366 3.076	SM	Main	s/c status o.k	View...
07-Jun-2007 (158) 13:38 - 13:48	2	NST	Victor	10723 / 10723	B	Main	1516 / 1336 0.965	SM	Main	ok	View...
07-Jun-2007 (158) 13:37 - 13:46	1	S69	Victor	14956 / 15138	B	Main	650 / 1850 1.802	SM	Main	ok	View...
07-Jun-2007 (158) 12:05 - 12:14	1	NST	Victor	14956 / 14956	B	Main	4709 / 5833 3.773	SM	Main	MI detected	View...
07-Jun-2007 (158) 12:04 - 12:11	2	S69	Victor	10707 / 10723	B	Main	4700 / 4573 2.666	SM	Main	ok	View...
07-Jun-2007 (158) 01:28 - 01:36	1	S67	Patrick	14933 / 14956	B	Main	672 / 1513 2.418	SM	Main	s/c status o.k...All CMDs CW723 on board!	View...
07-Jun-2007 (158) 01:25 - 01:35	2	NST	Patrick	10707 / 10707	B	Main	1377 / 15105 2.488	SM	Main	s/c status o.k	View...

08-Jun-2007 01:06

Pass #	Station	MMU	IPU	AOCs
1	S67	B	Main	SM

Std-Files (none)

Contact-Files Merge1 (85CMDs)
Merge2 (100CMDs)

Alarms (none)

Comment s/c status o.k

Multimission at GSOC

- OPSWEB (continued 2)

GRACE - Pass Log GRACE 1 & 2 - Mozilla

http://www.gsoc.dlr.de/grace

Operations Related

Pass Log GRACE 1

(Jump Station) (lookup selection in ...)

The OPS Pass Logs are filled out by the command operators after each pass.

List ☒ GR1 ☒ GR2 pass reports of CW 23 / 2007

AOS-LOS	Station	Cmd. Ctr. Pre / Post	Fill Rate
08-Jun-2007 (159) 00:57 - 01:06	S67	15138 / 15329	2393
08-Jun-2007 (159) 00:55 - 01:05	Patrick	B Main	3
07-Jun-2007 (158) 23:21 - 23:30	NST	10723 / 10723	4970
07-Jun-2007 (158) 13:38 - 13:48	Patrick	B Main	2
07-Jun-2007 (158) 13:37 - 13:46	NST	15138 / 15138	4300
07-Jun-2007 (158) 12:05 - 12:14	Patrick	B Main	3
07-Jun-2007 (158) 12:04 - 12:11	NST	10723 / 10723	1516
07-Jun-2007 (158) 01:28 - 01:36	Victor	B Main	0
07-Jun-2007 (158) 01:25 - 01:35	S69	14956 / 15138	650
	Victor	B Main	1
	NST	14956 / 14956	4709
	Victor	B Main	3
	S69	10707 / 10723	4700
	Victor	B Main	2
	S67	14933 / 14956	672
	Patrick	B Main	2
	NST	10707 / 10707	1377

GRACE - View GRACE 1 Pass Report - Mozilla

http://www.gsoc.dlr.de/graceweb/scripts/passlog_show.asp?id=15315

Operations Products

View GRACE 1 Pass Report

(Jump Station) (lookup selection in ...)


[GoTo \[Pass Report Overview\]](#)

The OPS Pass Logs are filled out by the command operators after each pass. You must be inside GSOC to add or edit records.

[\[Prev. Pass\]](#) [\[Next Pass\]](#)

GRACE 1							
AOS	(159) 08-Jun-2007 00:57	LOS	(159) 08-Jun-2007 01:06	Pass #	1	Station	S67
Operator	Patrick	Gas Cons. [g]	3.485	MMU	B	IPU	Main
Cmd. Ctr. Pre/Post	15138 / 15329	Fill Cnt HK / Sci	2393 / 3654	OBDR	Main	AOCS	SM
U/L-Requests (Recomm. #)	(none)	Std-Files	(none)				
ODL-Files	N_TRM_TBLS_DMP N_IDPGRP_DMP_RAM Hash	Contact-Files	Merge1 (85CMDs) Merge2 (100CMDs)				
Warnings	(none)	Alarms	(none)				
Conchecks	(none)	Comment	s/c status o.k				
Spare 1	(none)						

Multimission at GSOC - OPSWEB (continued 3)



TSXWEB Tools FOP List

Click on entry to view entry details. Search in entries


Filter: [None](#) | [All](#) | [ACE](#) | [ACS](#) | [AGP](#) | [AIM](#) | [AMG](#) | [AMT](#) | [AOC](#) | [ARC](#) | [ARW](#) | **[AST](#)** | [BUS](#) | [CCS](#) | [CE1](#) | [CE2](#) | [DEU](#) | [DRA](#) | [LCT](#) | [MOS](#) | [OBC](#) | [PLM](#) | [PWR](#) | [SAT](#) | [SR1](#) | [SR2](#) | [SS1](#) | [SS2](#) | [TCS](#) | [TOR](#) | [TTC](#) | [XDA](#) | [YSC](#)

36 procedures ordered by "Identifier"

Identifier	Title	Objectives	I.E.	Duration RT/TT	Last Modified
AST0010X	STR_HEALTH_CHK	Checkout of all three star cameras	<input type="checkbox"/>	00:00:00 / 00:00:01	16-May-2007 11:20
AST1000N	STR_ALIVE_TST	Perform a connection test for the three star cameras	<input type="checkbox"/>	00:00:00 / 00:00:01	16-May-2007 11:20
AST1011N	STR_1_ON	Switch on star camera 1	<input type="checkbox"/>	00:00:10 / 00:00:02	16-May-2007 11:20
AST1012N	STR_2_ON	Switch on star camera 2	<input type="checkbox"/>	00:00:10 / 00:00:02	16-May-2007 11:20
AST1013N	STR_3_ON	Switch on star camera 3	<input type="checkbox"/>	00:00:10 / 00:00:02	16-May-2007 11:20
AST1021N	STR_1_OFF	Switch off star camera 1	<input type="checkbox"/>	00:00:01 / 00:00:02	16-May-2007 11:20
AST1022N	STR_2_OFF	Switch off star camera 2	<input type="checkbox"/>	00:00:01 / 00:00:02	16-May-2007 11:20
AST1023N	STR_3_OFF	Switch off star camera 3	<input type="checkbox"/>	00:00:01 / 00:00:02	16-May-2007 11:20
AST1041N	STR_1_IMAGE_DUMP	Dump full CCD image for STR 1	<input type="checkbox"/>	00:00:07 / 00:10:09	16-May-2007 11:20
AST1042N	STR_2_IMAGE_DUMP	Dump full CCD image for STR 2	<input type="checkbox"/>	00:00:07 / 00:10:09	16-May-2007 11:20
AST1043N	STR_3_IMAGE_DUMP	Dump full CCD image for STR 3	<input type="checkbox"/>	00:00:07 / 00:10:09	16-May-2007 11:20
AST1045N	STR_1_PIXEL_DUMP	Dump of a reduced STR-1 image (pixels above a specified threshold o...	<input type="checkbox"/>	00:00:07 / 00:01:10	16-May-2007 11:20
AST1046N	STR_2_PIXEL_DUMP	Dump of a reduced STR-2 image (pixels above a specified threshold o...	<input type="checkbox"/>	00:00:07 / 00:01:10	16-May-2007 11:20
AST1047N	STR_3_PIXEL_DUMP	Dump of a reduced STR-3 image (pixels above a specified threshold o...	<input type="checkbox"/>	00:00:07 / 00:01:10	16-May-2007 11:20
AST1050N	STR_123_Decont_HTR_ON	If there are indications that the STR optics are contaminated by co...	<input type="checkbox"/>	00:00:15 / 00:00:16	16-May-2007 11:20
AST1051N	STR_123_Decont_HTR_OFF	One or more STR de-contamination heaters were switched on to allevi...	<input type="checkbox"/>	00:00:11 / 00:00:12	16-May-2007 11:20
AST3000N	STR_TLM_ON	AOCS telemetry for the star cameras	<input type="checkbox"/>	00:00:00 / 00:00:01	16-May-2007 11:20
AST3010N	STR_PAR_DMP	Dump STR commandable parameters (service PS04 and PS05)	<input type="checkbox"/>	00:00:04 / 00:00:03	16-May-2007 11:20
AST3111N	STR_1_SW_patch	Software upload into the EEPROM for STR 1; includes: -- pre- and p...	<input type="checkbox"/>	00:00:09 / 03:15:28	16-May-2007 11:20
AST3112N	STR_2_SW_patch	Software upload into the EEPROM for STR 2; includes: -- pre- and p...	<input type="checkbox"/>	00:00:09 / 03:15:28	16-May-2007 11:20
AST3113N	STR_3_SW_patch	Software upload into the EEPROM for STR 3; includes: -- pre- and p...	<input type="checkbox"/>	00:00:09 / 03:15:28	16-May-2007 11:20

Fertig

Login:	schmidhuber
Group:	MOT
Login Time:	(no login)
Version:	0,4

		
nd Telemetry	Display/ Branch	AIT Activity
	Next Step: 2	
	TC	

Multimission at GSOC

- OPSWEB (continued 4)

TSXWEB - FOP List - Mozilla Firefox

Click on entry to view entry details. Search

Filter: None | All | ACE | ACS | AGP | AIM | A | SR2 | SS1 | SS2 | TCS | TOR | TTC | XDA | Y

36 procedures ordered by "Identifier"

Identifier	Title
AST0010X	STR_HEALTH_CHK
AST1000N	STR_ALIVE_TST
AST1011N	STR_1_ON
AST1012N	STR_2_ON
AST1013N	STR_3_ON
AST1021N	STR_1_OFF
AST1022N	STR_2_OFF
AST1023N	STR_3_OFF
AST1041N	STR_1_IMAGE_DUMP
AST1042N	STR_2_IMAGE_DUMP
AST1043N	STR_3_IMAGE_DUMP
AST1045N	STR_1_PIXEL_DUMP
AST1046N	STR_2_PIXEL_DUMP
AST1047N	STR_3_PIXEL_DUMP
AST1050N	STR_123_Decont_HTR_ON
AST1051N	STR_123_Decont_HTR_OFF
AST3000N	STR_TLM_ON
AST3010N	STR_PAR_DUMP
AST3111N	STR_1_SW_patch
AST3112N	STR_2_SW_patch
AST3113N	STR_3_SW_patch

Fertig

TSXWEB - AST1042N - Mozilla Firefox

Flight Procedure
AST1042N

Flight Procedure Overview

Flowchart | Proc. Body | Proc. Cover | Extra

STR_2_IMAGE_DUMP
File: AST1042N.xls
Author: JHerman

TERRASAR **EADS ASTRIUM DLR**

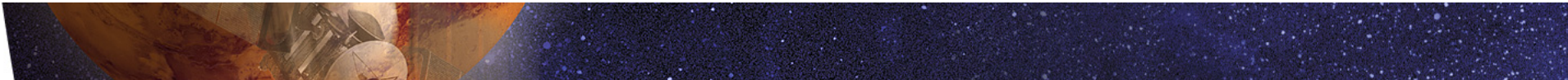
Step	Label/Time	Activity/Remarks	Telecommand	Telemetry	Display/ Branch	AIT Activity
	duration: 0000.10.00	Beginning of Procedure				
		Procedure Properties Formal Parameters STARTTIME as<abs> = 2019.360.12.30.00.000				
1		AST1042N			Next Step: 2	
		Procedure for making a CCD image with star camera 2. The complete pixel information is read out in this procedure. This may take up to 9 minutes (depends upon the amount of information in the picture). An alternative to this procedure with full read-out is procedure AST1046N STR_2_PIXEL_DUMP, where only pixels above a specified threshold will be read-out. Note: STR 2 can not be used in the AOCs control loop during image dump, so it must be ascertained that at least one of the two other cameras can be used.				
	TimeTag: ET=STARTTIME+ UT+00.00.00	CCCC00001 COMMENT Command Parameter(s): COMMENT = AST1042N STR_2_IMAGE_DUMP <str>	CCCC00001		TC	
		Note: image time is 8 sec. after starttime of procedure.				
		Check status of STR 2				

javascript:go_home()



Multimission at GSOC - Restrictions

- In some cases contractual obligations suggest or mandate the use of other components
 - E.g. use of M&C system already qualified and used for the spacecraft bus assembly and checkout
 - In the long run (5 years of routine operations plus possible extensions) even the configuration of the GSOC generic system components leads to a more cost-efficient scenario



Multimission at GSOC

- Summary

- Since 2000 GSOC successfully operated four spacecraft in a multimission environment
- The system will be augmented by up to four new missions until 2010
- Operating satellites in multimission significantly reduced the costs
- Besides cost reduction, multimission has more advantages:
 - A common team of operators ensures the know-how
 - A common environment makes working easier and more transparent
 - A common system enforces setting-up and keeping house-standards
- Even if not every new project can be set-up completely with the generic system, they too can profit from the commonality